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(72) Inventors:
• **Block, Barry**
Los Altos, California 94022 (US)
• **Thornton, Arnold O.**
San Jose, California 95132 (US)
• **Daschner, Walter**
Mountain View, California 94040 (US)

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(71) Applicant: **Aerial Imaging Corporation**
San Jose, CA 95134 (US)

(74) Representative: **Gill, David Alan**
W.P. Thompson & Co., Celcon House, 289-293
High Holborn
London WC1V 7HU (GB)

(54) **An optical or magneto-optic head and method of making the same**

(57) A method for forming a novel head used in magneto-optic or optical disks comprises the steps of forming a diffractive lens on one side of a glass substrate and forming air bearing surface rails on a second side of said glass substrate. The glass substrate is then cut into separate heads. In this way, many magneto-optic or optical heads can be formed simultaneously without

incurring the expense of bonding lenses onto a slider. In one embodiment, coils are deposited on the substrate to generate a magnetic field during magneto-optic write operations. In another embodiment, a glass wafer having diffractive lenses formed thereon is bonded to a silicon spacer structure. The glass lenses are used to define a waveguide structure on a transparent layer on the bottom of the silicon spacer structure.

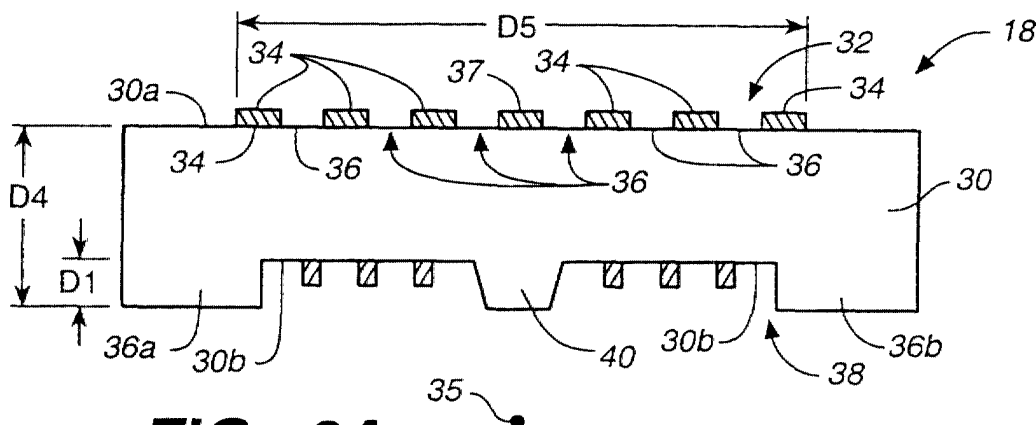


FIG. 2A



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EUROPEAN SEARCH REPORT

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	EP 0 226 647 A (IBM DEUTSCHLAND ; IBM (US)) 1 July 1987 (1987-07-01)	1,2,4-7, 12,13, 18,19, 23,27 16	G11B7/22 G11B7/12 G11B11/10
A	* column 3, line 7 - column 4, line 37; figures 1,2,6 * * column 6, line 7 - line 19 * ---		
X	US 5 497 359 A (MAMIN HARRY J ET AL) 5 March 1996 (1996-03-05) * column 6, line 15 - line 32 * * column 7, line 40-63; figure 8 * ---	19	
X	DE 44 04 635 A (HITACHI LTD) 18 August 1994 (1994-08-18)	23	
A	* column 13, line 24 - column 14, line 49; figures 12-14 * ---	22,24,25	
X	EP 0 731 417 A (SYMBOL TECHNOLOGIES INC) 11 September 1996 (1996-09-11)	27	
A	* column 17, line 29 - column 18, line 27; figure 5 * ---	1,12,16, 18,22, 23,25	TECHNICAL FIELDS SEARCHED (Int.Cl.6) G11B
X	DÄSCHNER, W ET AL: "Cost-effective mass fabrication of multilevel diffractive optical elements by use of a single optical exposure with a gray-scale mask on high-energy beam-sensitive glass" APPLIED OPTICS, vol. 36, no. 20, 10 July 1997 (1997-07-10), pages 4675-4680, XP002181263 WASHINGTON, DC * the whole document * ---	27	
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The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 26 October 2001	Examiner Holubov, C
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ----- & : member of the same patent family, corresponding document	

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CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing more than ten claims.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

☐ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☒ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

☐ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:



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EUROPEAN SEARCH REPORT

Application Number
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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	WO 98 09284 A (QUINTA CORP) 5 March 1998 (1998-03-05) * page 19, line 13 - line 28; figures 1,4 *	28	
X	US 4 626 679 A (KUWAYAMA TETSURO ET AL) 2 December 1986 (1986-12-02) * figure 3 *	28	
A	US 5 544 131 A (ALBERTINI JEAN B ET AL) 6 August 1996 (1996-08-06) * column 5, line 47 - column 7, line 4; figure 9 *	1,2,9,11	
A	US 5 494 473 A (DUPUIS DAVID J ET AL) 27 February 1996 (1996-02-27) * column 5, line 26 - line 31; figure 5 * * column 9, line 33 - line 34 *	1,16,18	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
Place of search THE HAGUE		Date of completion of the search 26 October 2001	Examiner Holubov, C
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

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**LACK OF UNITY OF INVENTION
SHEET B**

Application Number
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The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. Claims: 1-18, 27

Methods of manufacturing heads and a method of manufacturing diffractive lenses. Claimed subject-matter is linked by a step of forming a plurality of lenses on a transparent substrate, but this is known in the prior art (see, for example, EP731417 column 17 lines 37-40)

2. Claims: 19-26

Heads for use in conjunction with a magneto-optical or optical disk/media. The claims have in common a lens formed on a transparent body/substrate, but this is known in the prior art (see for example: EP226647, Figure 1; US5497359 col 6 lines 14-28; DE4404635 Figure 12)

3. Claims: 28,29

Optical of magneto-optic data drive in which the diffractive lens is not directly thermally coupled to the laser. This is known in the prior art (see, for example, US4626679, W0980928)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

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26-10-2001

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0226647 A	01-07-1987	EP 0226647 A1	01-07-1987
		AU 586720 B2	20-07-1989
		AU 6647086 A	18-06-1987
		BR 8605867 A	25-08-1987
		CA 1258123 A1	01-08-1989
		DE 3583039 D1	04-07-1991
		JP 7021874 B	08-03-1995
		JP 62146444 A	30-06-1987
		US 4866694 A	12-09-1989
US 5497359 A	05-03-1996	NONE	
DE 4404635 A	18-08-1994	JP 3070887 B2	31-07-2000
		JP 6243470 A	02-09-1994
		JP 6251410 A	09-09-1994
		DE 4404635 A1	18-08-1994
		US 5481386 A	02-01-1996
		US 2001012244 A1	09-08-2001
		US 5715226 A	03-02-1998
		US 6185177 B1	06-02-2001
		US 5995474 A	30-11-1999
EP 0731417 A	11-09-1996	EP 0731417 A2	11-09-1996
		JP 9050476 A	18-02-1997
		US 6257491 B1	10-07-2001
		US 6059188 A	09-05-2000
		US 6062476 A	16-05-2000
		US 6024283 A	15-02-2000
WO 9809284 A	05-03-1998	US 6044056 A	28-03-2000
		CN 1230278 A	29-09-1999
		EP 0939955 A1	08-09-1999
		EP 0922282 A1	16-06-1999
		EP 0922283 A1	16-06-1999
		EP 0929894 A1	21-07-1999
		EP 0922284 A1	16-06-1999
		EP 0922281 A1	16-06-1999
		JP 2001502462 T	20-02-2001
		US 6275455 B1	14-08-2001
		WO 9809284 A1	05-03-1998
		WO 9809285 A1	05-03-1998
		WO 9809279 A1	05-03-1998
		WO 9809392 A2	05-03-1998
		WO 9809286 A1	05-03-1998
		WO 9809287 A1	05-03-1998
		WO 9809280 A1	05-03-1998

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

26-10-2001

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9809284 A		WO 9809288 A1	05-03-1998
		WO 9809289 A1	05-03-1998
		US 6134207 A	17-10-2000
		US 6181673 B1	30-01-2001
		US 6301403 B1	09-10-2001
		US 5940549 A	17-08-1999
		US 5850375 A	15-12-1998
		US 6058094 A	02-05-2000
		US 6178150 B1	23-01-2001
		US 5892745 A	06-04-1999
		US 6061323 A	09-05-2000
		US 6226233 B1	01-05-2001
		US 6034938 A	07-03-2000
		TW 432370 B	01-05-2001
US 4626679 A	02-12-1986	JP 1749101 C	08-04-1993
		JP 4039131 B	26-06-1992
		JP 59054046 A	28-03-1984
		JP 59056236 A	31-03-1984
		JP 59056239 A	31-03-1984
		DE 3334120 A1	22-03-1984
US 5544131 A	06-08-1996	FR 2705488 A1	25-11-1994
		EP 0624871 A2	17-11-1994
		JP 6349004 A	22-12-1994
		US 5642336 A	24-06-1997
US 5494473 A	27-02-1996	NONE	